# Anti-Kaon Production Heavy Ion Collisions*

*J. Schaffner-Bielich*[$], *V. Koch, and M. Effenberger*[†]

The in medium change of the anti-kaon mass as evidenced from the study of kaonic atoms has lead to many theoretical speculations, most notably the possible existence of a anti-kaon condensate inside a neutron star. Recently, experimental data for the subthreshold production of anti-kaons also seem to suggest a reduced in medium mass [1]. To investigate this we study in medium modifications of anti-kaons in dense matter in a coupled channel calculation [2] for scenarios more closely related to the environment encountered in heavy-ion collisions. We find that the optical potential of the anti-kaons turns repulsive for finite momenta or finite temperature. However, the same calculation predicts a remarkable increase of the in-medium production cross section of anti-kaons via pions and $\Sigma$ hyperons.

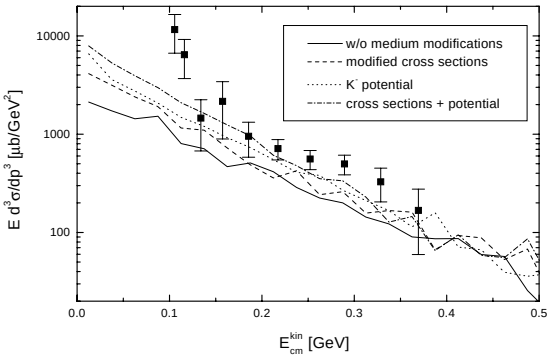


Figure 1: Inclusive invariant $K^-$ production cross section for Ni+Ni collisions at 1.8 AGeV. Note that in the theoretical calculations the experimental acceptance cut is not applied. The experimental data are taken from Ref. [3].

Including these effects into a transport model [4] we find only small corrections due to the medium. Even our calculation without any in medium effect is in reasonable agreement with the data (see figs. 1, 2). Thus, at present the question about the in medium mass of anti-kaons at high density is still open.

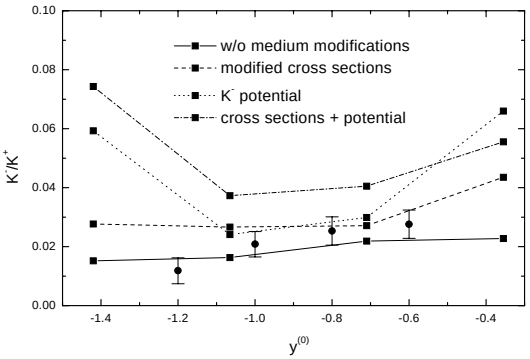


Figure 2: Effects of in-medium modifications on the $K^-/K^+$ ratio in Ru+Ru collisions at 1.69 AGeV for $b < 4$ fm as function of normalized rapidity: Without in-medium modifications (solid line), with modified cross sections for $\pi Y \leftrightarrow \bar{K}N$ at $p = T = 0$ (dashed line), with the $\bar{K}$-potential at $p = T = 0$ (dotted line), with modified cross sections and potential (dash-dotted line). The experimental data are taken from Ref. [5].

[1] G.Q. Li et al., Phys. Rev. Lett. 79 (1997) 5214.
[2] V. Koch, Phys. Lett. B337 (1994) 7.
[3] R. Barth et al., Phys. Rev. Lett. 78 (1997) 4007.
[4] S. Teis et al., Z. Phys. A356 (1997) 421.
[5] N. Herrmann, Prog. Part. Nucl. Phys. 42 (1999) 187
.

* LBNL-41395

[$]RIKEN BNL Research Center Brookhaven National Laboratory, Upton, NY 11973, USA.
[†]Institut fuer Theoretische Physik, University Giessen, D-35392 Giessen, Germany